

## **Summary of review action items and homework problems from sPHENIX MAPs mini-review 06/30/16**

### **Project, schedule, budget and resource issues:**

1. Estimate how long it will take to put a LANL-CERN agreement of cooperation on sPHENIX MAPs into place. Immediately address the details of this once the LDRD is approved.
2. Determine whether the MAPs sensors received by sPHENIX are tested or raw (untested)? If tested, who does the testing, CERN or LANL personnel sent to CERN? Is labor for this accounted for in project file?
3. Rearrange the WBS procurement tasks by grouping them into common sets of procurements. Arrange the sets of procurements in the schedule to occur in parallel rather than the current serial procurement structure. Not enough time is allocated for procurement. Evaluate and modify as appropriate. Identify long lead items for orders and ensure that they are properly included in the schedule.
4. Match the LDRD budget profile with the MAPs project schedule.
5. Define the complete scope for MAPs in the sPHENIX Project. What are the MAPs activities and deliverables that are covered by the sPHENIX Project?
6. The “Tooling (for final assembly)” tasks in the WBS needs to be more specific. The design time seems short. Try to get additional information on tooling from the ALICE ITS project and base the sPHENIX tooling plans on this information.
7. Specify stave shipping times for sPHENIX and add it to the project schedule as appropriate. Take into account import/export times, shipping memo approvals, etc. Does the shipping time for any other items need to be accounted for in the project plan?
8. Determine whether the travel and per-diem costs for personnel stationed at CERN are in the project costs. Are they in the LDRD budget?
9. Identify facilities and lab space at CERN needed for sPHENIX MAPs assembly and testing. Will there be a competition for resources? Can we reserve the needed CERN facilities/space so that they will not be oversubscribed?
10. All scientist salaries for sPHENIX should be off-project. Is the LANL Engineers/Tech labor directly charged to the LDRD, the project or is it part of an overhead pool? Mechanical and electrical designers seem missing from the labor plan. Evaluate the need, splitting tasks currently assigned to engineers between engineers and designers as appropriate, and modify the plan. Reflect this change in the project plan and resource table.
11. Level the resources in project file. Create an FTE profile sorted by FY and resource category. One must be able to defend labor profile. Include student labor (no cost) in the project plan and resource table.
12. Make sure that stave testing is in the project schedule. Exercise the readout of each stave prior to assembling them on the detector. Individual readout tests 1day/stave.
13. The commissioning of the fully installed sPHENIX detector lasts for 2 months starting April 2021. The MAPs detector must be completely installed and tested prior to the beginning of commissioning. The schedule should reflect this.

14. The "Survey after installation" tasks are currently placeholders in sPHENIX project files. They need to be more detailed once the Tracker is better specified.
15. Add tasks for reviews; leave time in the schedule for review prep and response. Add milestones for passing reviews, design complete, ready for production, ready to install, etc.
16. The Org chart needs to be better defined. Produce an organization chart with an L2 manager and L3 managers, etc.
17. L3 project manager only 20%? This is the minimum time commitment from an L3 manager but the scope of the MAPs may require a larger time commitment. Work with sPHENIX Project Management to assign an appropriate time commitment to the job of MAPs manager.
18. Justify the level of spares and compare/contrast with the ALICE strategy. Define spares at the stave level - otherwise we would need a new lab to assemble staves from parts. Is 20% spares adequate? ALICE is building 120% spares.
19. Confirm the number of spares needed for all purchases and include in the project plan.
20. Link start of material procurement/fabrication to funding cycle and CD process.
21. Task 101 is "Produce staves" with a fixed cost of \$700K and duration of 6 months. The duration seems short. Reevaluate and modify if appropriate.
22. Define interface regions – what is part of the MAPs WBS, what is left to others? For instance mechanical support, transport tooling, installation tooling, etc. Provide information on the interface requirements in order to allow for an accurate estimate of installation and integration costs and schedule.
23. Work with the sPHENIX engineers to get the MAPs installation tasks added to the sPHENIX Installation & Integration WBS.
24. Verify the labor hourly rates in the resource table. They seem high. The hourly rate should include fringe but not overhead.
25. Understand the LANL burden numbers and incorporate into the plan.
26. Establish direct and indirect rates by institution (including OH) as applicable.
27. Milestones should be 0 day duration tasks. Line 63, "Obtain ALICE CAD model" should be a milestone.
28. Make sure tasks, not summary tasks, have predecessors and successors.
29. Produce a well-defined model, starting with a block diagram that clearly delineates the electronics R&D issues. It is important to understand the scope-of-work for all custom readout electronics of the MAPs project. Specify the scope of electronics engineering to be done by LANL.
30. Need to clarify what it means to "acquire" the electronics design. If it is the full layout, then the LANL designer must be able to use the design software used for the ALICE layout. If it is only schematics, then time has to be included for layout. This effort is potentially very expensive in terms of engineering time. (3 rounds of prototyping assumed). It may take time to get permission to acquire the design. Is there reasonable time to do this task? Is the design considered proprietary information that will need to be addressed?
31. Evaluate the amount of electronic engineering. Even though it is a "copy" of the ALICE system, it most likely require more time than currently expected to integrate that readout with the sPHENIX electronics.

32. Time to complete the first round prototyping should probably be increased, for both the assembly and testing. Second and third prototypes will move faster since the changes will (hopefully) be small and the tools will be in place from the first prototype.
33. Define the "safety system" in the WBS dictionary.
34. Add an early technical review of the mechanical and electronic design.
35. The single \$785k procurement of ladders is a red flag. Are additional tasks needed to support this?
36. Use the MS-Project Fiscal Year calendar option. For the MAPs scheduling consider adding CERN holidays for tasks to be done at CERN; even for US. E.g. 12/20-1/4 is rarely productive.
37. Add the issue of using retired engineers to the mitigation risk plan. One needs a back-up plan to replace key personnel in case of full retirement. Isn't the ME listed in the project plan retired?
38. Need to better understand the CERN costing, and what CERN might charge for the assembly work. Reconcile the CERN sensor/stave cost estimate with those for the STAR HFT. There is potentially a factor of 2 difference between them. The tables as given by Musa may be an underestimate.
39. Define through consultation with CERN what MAPs assembly tasks can only be performed by the CERN-ITS assembly experts and what tasks can be taught to others through training.
40. Determine whether the slow control design has associated M&S costs.
41. Make sure that schedule includes sufficient time for testing protocols, and software development.
42. Have procurement staff and engineering staff cross check cost/schedule/resource estimates – if they did not supply initial estimate or durations
43. The half barrel mechanical design needs to have the scope well defined with interface points, services provided, etc.
44. Is all cabling included in the project plan? Add if necessary.
45. Document the LANL procurement rules in preparation for the Cost and Schedule review
46. Plan for testing software.

#### **Technical Issues to address:**

1. Better specify the electronics readout chain. Is the signal driven to readout units copper or fiber? Is all power accounted for? What is the power/channel or power/sensor estimate? What is the R&D plan? Produce a clear block diagram of the readout chain. Define how the MAPs readout scheme integrates into the sPHENIX DAQ? Need a concept on how this will be done.
2. What are the test beam plans? Are test beams at LANL possible? Is the MAPs R&D effort going to be tied to sPHENIX test beams?
3. Is the internal support structure costed as carbon fiber? Need to confirm.
4. Where will the final MAPs assembly take place? At BNL in the Phys Dept VTX lab? Is there any need for a clean room at BNL for this work?

5. Need to understand the power loads for the detector. Evaluate the MAPs PS needs. MAPs needs Low Voltage and no additional bias. A plan is needed with details for the power systems, cabling and cooling. The cooling system will be a challenge.
6. The ALICE CRU is based on the GBTx chip. Do we need this chip and can we get it?
7. What are the cable lengths expected between the MAPs and the location of the readout units? The ALICE block diagram indicates that the length is 4-5 m. Are the readout units inside or outside the magnet? What is the distance between the detector and sPHENIX IR racks? Need to evaluate the number of racks required both in the IR and rack room for the MAPS detector.
8. The sub-system should specify its downstream computer needs as per data volume etc.
9. Add details for slow controls and power distribution

### **Preparation for the Tracker Review:**

1. It will be important to demonstrate at the Tracker review that the MAPS project can be done with the manpower committed to the project. Levels of participation and commitments by interested institutions, such as MIT, should be specified in preparation for the review.
2. Identify interests and commitments of the RIKEN/RBRC group prior to the Tracker Review
3. It was stated that CERN may allow a mortgage, or loan to LANL in order to buy sPHENIX staves as part of ALICE production. It might be hard to sell this to a review committee. Confirm the possibility of such an arrangement prior to the review.
4. Do not overly emphasize the details of the LANL LDRD. The focus for the Tracker Review and beyond needs to be on the larger picture of the full sPHENIX.
5. Need Basis of Estimate for all large fixed costs. At the mini-review we said that we do not need the Basis of Estimate documents until the Nov. 2016 review. However those organizing the September Tracker Review have recently asked for BOE documents and WBS dictionary for the Tracker subsystems.
6. For future presentations it would be very useful to have a better description of the sPHENIX MAPS detector. Present a detailed block diagram of the sPHENIX MAPS tracking system electronics. It should include all types and number of modules required, along with an indication of where they are located (e.g. inside magnet, racks nearby)
7. When presenting the MAPs readout scheme at the review clearly identify what will be covered by LDRD funds and what will be covered by project funds with the caveat that all is not yet known.
8. Prepare responses for review that address high level risk mitigation items ( CERN lab not available, LDRD starts later with lower funding)